Remarks

The Applicant first wishes to thank the Examiner for the courtesy extended to Applicant's attorney during the telephonic interview on February 4, 2004, during which the pending claims and art of record including Chen (US 6,104,074); Tischler et al. (US 5,679,152); Tadatomo et al. (US 6,225,650); Soares (US 6,034,404); McTeer (US 6,258,466); Mueller (US 4,902,136); Gerner et al. (US 5,698,865); and Saito et al. (US 6,121,634) were discussed.

The Office Action, mailed on November 19, 2003, has been carefully considered. In that Office Action, Claims 1-49, 59-106, 124, and 125 were rejected. Applicant reaffirms that Claims 50-58 and 107-123 have been canceled, without prejudice to the subject matter therein, as being directed to a non-elected invention. Applicant respectfully requests reconsideration of the application by the Examiner in light of the following remarks.

Claims 1-5, 14, 18-19, 33, 36, 59-62, 71, 75-76, 124, and 125 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen (US 6,104,074) in view of Tischler et al. (US 5,679,152) and Tadatomo et al. (US 6,225,650). Independent Claims 1, 59, 124, and 125 recite, in combination with other features, a homoepitaxially grown single crystal gallium nitride wafer.

The Office Action states at page 10 in the section entitled "Response to Arguments":

> Applicant submits that neither Chen no [sic] Tischler et al. nor Tadatomo et al. teaches or suggests homoepitaxially grown a single crystal gallium nitride substrate (page 22). However, Tischler et al. teach heteroepitaxially growing an n-GaN layer 30 on a silicon handling substrate and epitaxially grown an GaN substrate 26 over the n-GaN layer 30 (fig. 2-6). An GaN substrate epitaxially grown on an immediate n-GaN layer is homoepitaxially grown. This meets the claimed limitation.

Applicant respectfully disagrees. For one thing, Tischler et al. characterizes the growth of the Ga*N as heteroepitaxial when discussing the use of so-called buffer layers to improve crystal quality, for example, at Col. 9, lines 4-8 reproduced below.

> ... This so-called buffer layer is commonly used in heteroepitaxial growth to improve crystal quality. For example, in this case it may comprise a grown layer of silicon on the sacrificial silicon substrate, to improve the surface of the substrate before deposition of the Ga*N. ...

Emphasis Added

Further, Tischler et al. teaches at Col. 9, lines 32-35 that the silicon-doped GaN layer 82 shown in Figure 8 is "formed by diffusion of silicon out of a sacrificial silicon substrate during the growth of the single crystal GaN article, as described above." At Col. 6, lines 29-48, Tischler et al. states:

> It is possible that the constituents of the sacrificial substrate may act as a dopant for the desired substrate layer, either by a solid state diffusion process through the interface between the sacrificial substrate and into the Ga*N layer or by "auto-doping," wherein the some [sic] amount of the sacrificial substrate material enters the vapor phase at the growth temperature and dopes the Ga*N layer as it is growing. If this latter situation is the case, the back side of the sacrificial substrate could be covered with a suitable mask such as silicon dioxide or silicon nitride to prevent autodoping of the grown layer. However, there may be some diffusion of the sacrificial substrate material into the desired grown layer at the interface. This could be beneficial, as for example in the case of a sacrificial silicon substrate and a grown GaN layer, in which the silicon would form a heavily doped n-type layer at the back of the substrate. Such heavily doped n-type layer would be advantageous for forming n-type ohmic contacts. If this layer were not desired, it could be etched or polished off after the growth process had been completed.

The teachings of the above-cited paragraphs would therefore lead one skilled in the art to conclude that the single crystal Ga*N 26 is heteroepitaxially grown, and that a diffusion of silicon from the silicon substrate 20 into the heteroepitaxial Ga*N 26 creates the layer 30 of silicon-doped n-type Ga*N depicted in Figures 5 and 6. Thus, layer 30 of silicon-doped n-type Ga*N and single crystal Ga*N 26 are heteroepitaxially grown.

As Applicant discussed in the response mailed to the USPTO on September 10, 2003, neither Chen nor Tischler et al. nor Tadatomo et al., whether taken alone or in combination, teach or suggest all the elements of the claimed invention. Namely, none of the references teaches nor suggests a photodetector comprising a substrate comprising a homoepitaxially-grown single crystal gallium nitride wafer, in combination with the other recited features. Clearly, a homoepitaxially-grown single crystal gallium nitride substrate, in combination with the other recited features of the present invention, is different from and inventive over the heteroepitaxially-grown materials of Chen, Tischler et al., and Tadatomo et al. As the references fail to teach or suggest the combination of claim limitations of the present invention, Applicant respectfully submits that a *prima facie* case of obviousness has not been made. Applicant therefore submits that the rejection of the of Claims 1, 59, 124, and 125 and the claims dependent thereon under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Tischler et al. and Tadatomo et al. should be withdrawn.

Further, the Examiner is reminded that it is well established that (1) a process limitation appearing in a claim does not convert it to a product by process claim; (2) product claims may include process steps to wholly or partially define the claimed product; and (3) to the extent these process limitations distinguish the product over the prior art, they must be given the same consideration as traditional product characteristics.

Claims 6-9, 15-17, 20-22, 63-66, 72-74, 77-79, and 107 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Soares (US 6,034,404). As noted above, Chen discloses basal plane sapphire substrates, not a single crystal gallium nitride substrate. As the shortcomings of Chen are not cured by Soares, the 35 U.S.C. § 103(a) rejection of Claims 6-9, 15-17, 20-22, 63-66, 72-74, 77-79, and 107 is improper and should be withdrawn.

Claims 10-13 and 67-70 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of McTeer (US 6,258,466). As with Chen in view of Soares, the shortcomings of Chen are not cured by McTeer. As the shortcomings of Chen are not cured by McTeer, the 35 U.S.C. § 103(a) rejection of Claims 10-13 and 67-70 is improper and should be withdrawn.

Claims 23-32, 34-35, 37-44, 80-92, and 94-101 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Mueller (US 4,902,136) and Gerner et al. (US 5,698,865). As with Chen in view of Soares, the shortcomings of Chen are not cured by Mueller and Gerner et al. As the shortcomings of Chen are not cured by Mueller and Gerner et al., the 35 U.S.C. § 103(a) rejection of Claims 23-32, 34-35, 37-44, 80-92, and 94-101 is improper and should be withdrawn.

Claims 45-49 and 102-106 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen (US 6,104,074) in view of Saito et al. (US 6,121,634). As with Chen in view of Soares, the shortcomings of Chen are not cured by Saito et al. As the shortcomings of Chen are not cured by Saito et al., the 35 U.S.C. § 103(a) rejection of Claims 45-49 and 102-106 is improper and should be withdrawn.

In light of the remarks presented herein, Applicant submits that Claims 1-49, 59-106, 124, and 125 of the case are in condition for immediate allowance and respectfully requests such action. If, however, any issues remain unresolved, the Examiner is invited to telephone the Applicant's counsel at the number provided below.

Respectfully submitted,

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Schenectady, New York
Date: February 5, 2004

CERTIFICATE OF TRANSMISSION

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